FIG.1

FIG.2 A

FIG.2A

Substrate	Coupling Agent (X = silane or thiol)		Template Layer (Z = siloxane or metal sulfide)	
OH MO_x M = Si, Ti, In, Fe, ... 40	A R SiY$_3$ 42	A = -NH$_2$ or R = alkyl or phenyl Y = halogen or alkoxy	H$_2$N (CH$_2$)$_{n=2-6}$ Si O O O 44	NH$_2$ Si n=1-4 O O
M or MM' M = Au, Pt, Cu, ... MM' = GaAs, CdSe, ... 41	NH$_2$ R SH 42	or NH$_2$ NH$_2$ R R S — S R = alkyl or phenyl	NH$_2$ (CH$_2$)$_{n=2-6}$ S 44	NH$_2$ n=1-4 S
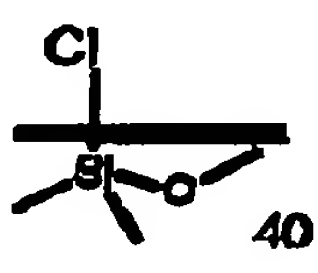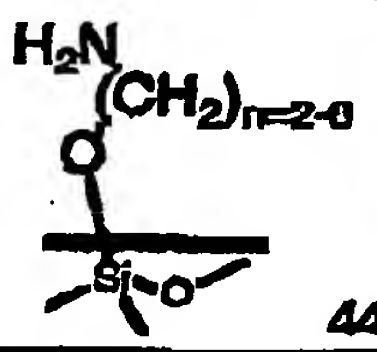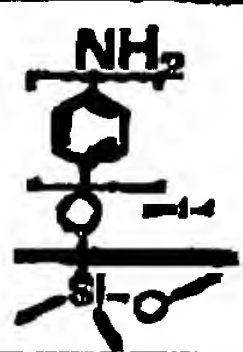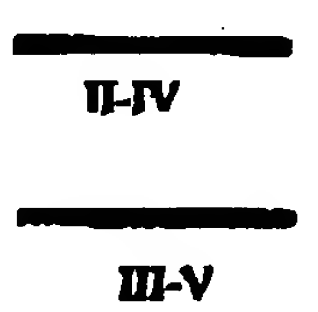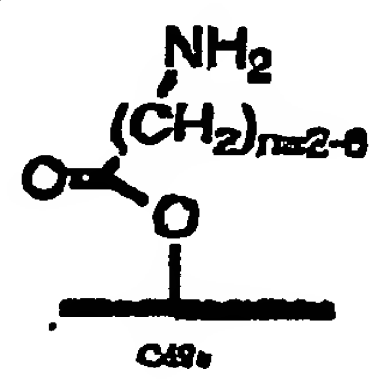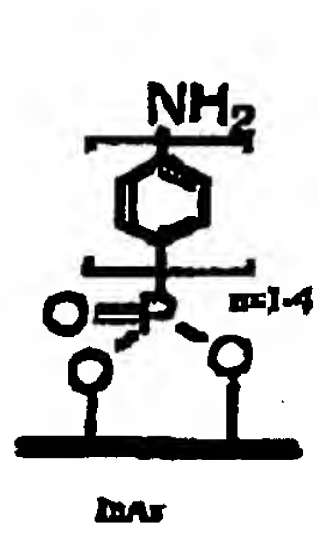
FIG.2B

Substrate	Coupling Agent	Template Layer
	(X = OH, CO₂H, PO₃H₂)	(Z = alkoxysilane, phosphate or carboxylate)
Cl Si-O 40	HO-R-NH₂ R = alkyl or phenyl 42	H₂N (CH₂)ₙ₌₂₋₆ O Si-O 44 NH₂ Si-O
II-IV III-V 41	HOOC-R-NH₂ (HO)₂OP-R-NH₂ R = alkyl or phenyl 42	NH₂ (CH₂)ₙ₌₂₋₆ O O C49ₐ 44 NH₂ O—P—O InAs

FIG.2B cont'd

FIG.3A

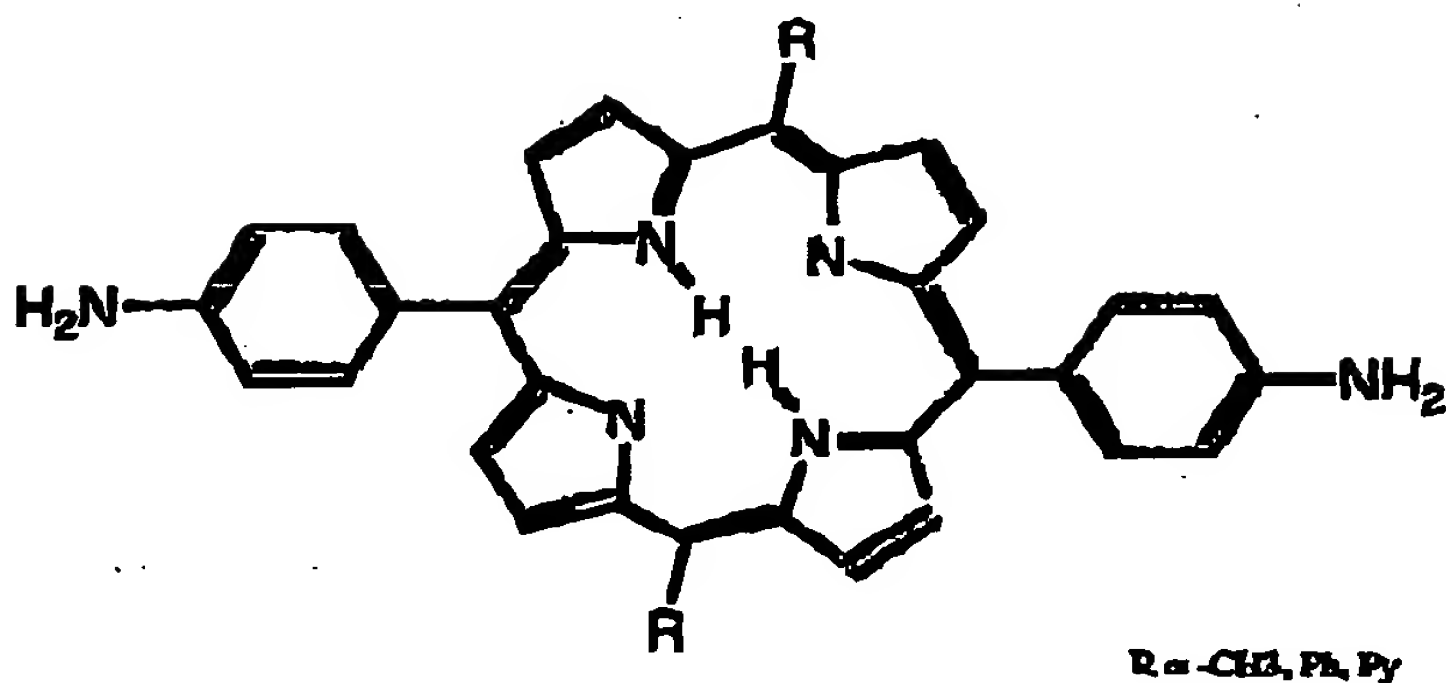| A	B	C	Ins./SC	Cond./SC	
-NH₂	(structure)	(structure)	A—▭—A	B—▭—B → Ins./Cond.	
R—NH₂ / R—NH₂	(structure)	(structure)	-(CH₂)ₙ- n=1-12	oligothiophene {S}ₙ n=1-6	
-NH₂	(structure)	(structure)	H₂ C n=0-5	oligoaniline ₙ=1-6	
-SiCl₃	-OH	(structure)	B—(π)—B	A—(π)—A → SC/SC	
(structure) Cl	-OH	(structure)	naphthalene perylene terylene anthracene pentacene	porpherine phthalocyanine	

FIG.3B

N=1,2,3

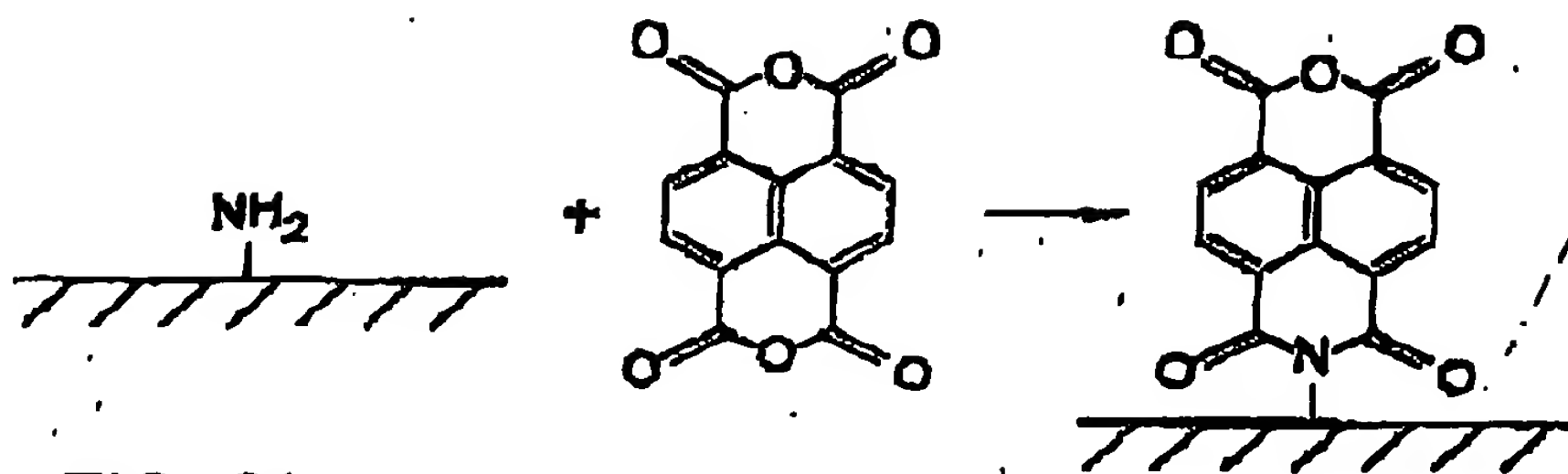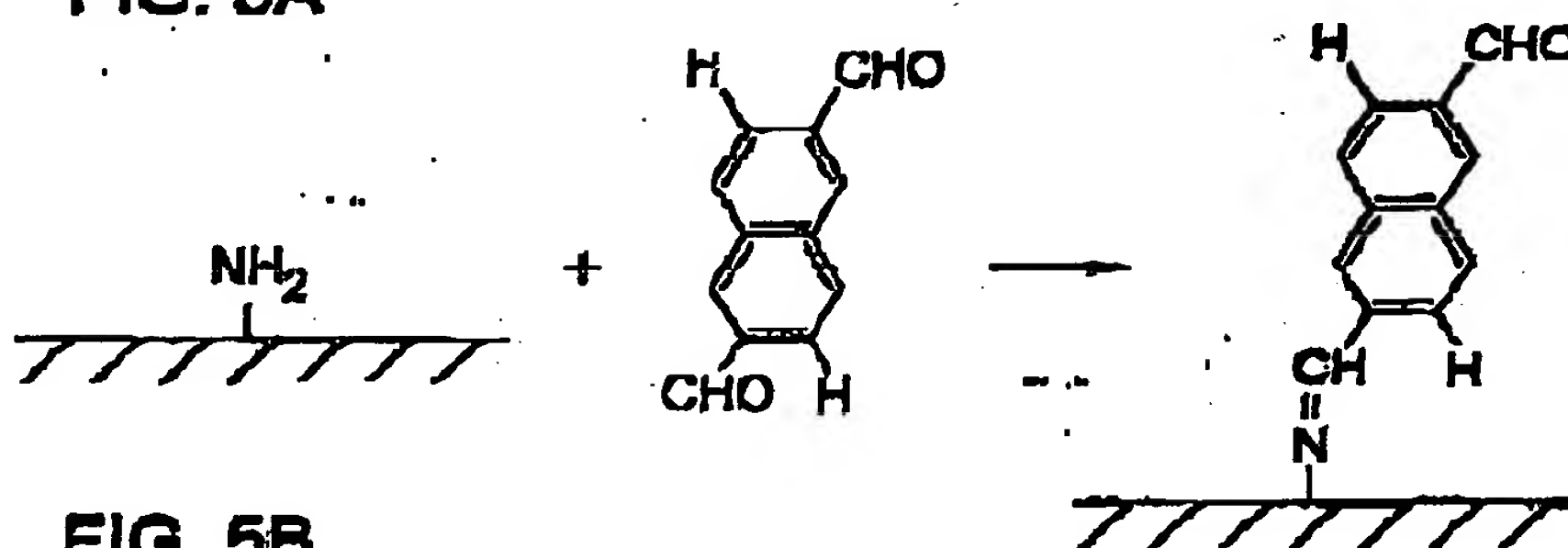FIG.4A

FIG.4B

R = -CH3, Ph, Py
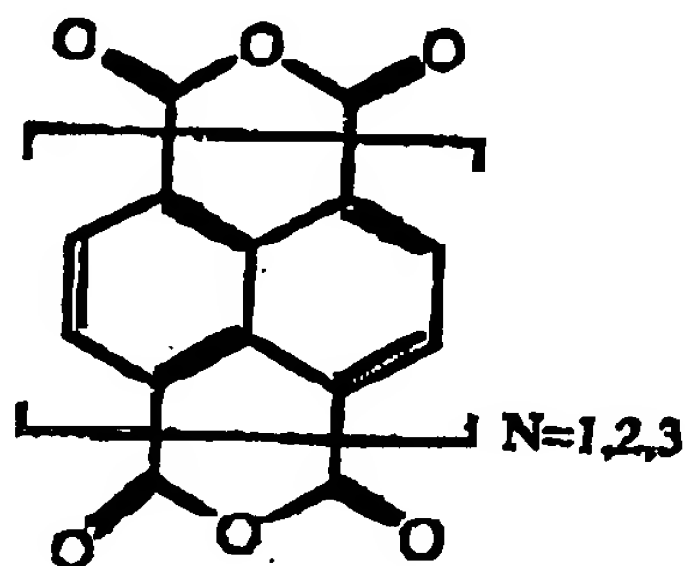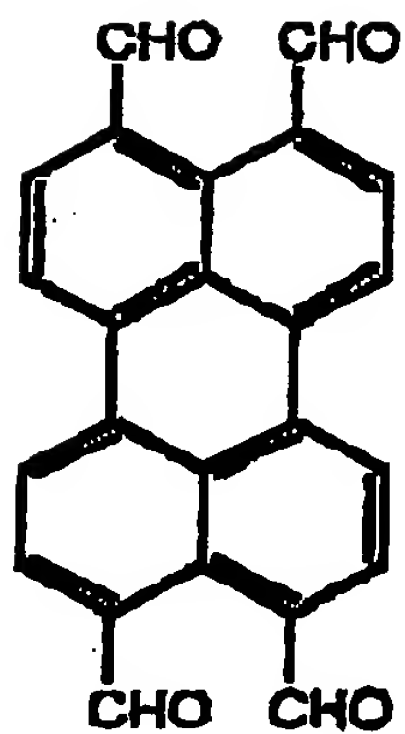
FIG.4C

FIG. 5A

FIG. 5B

FIG. 5C

FIG. 5D

ORGANIC
SUPERLATTICE

Fig. 6

Psi IN
DEGREES

DELTA IN
DEGREES

40

35

30

25

20

15

10

85

80

75

70

65

200   400   600   800   1000

WAVELANGTH (nm)

FIG.7

ITENSITY
(a.u.)

0.035

0.030

0.025

0.020

0.015

0.010

0.005

0.000

n=9

n=4

n=3

n=2

n=1

350   450   550   650

WAVELANGTH (nm)

FIG.8

FIG.9

WAVELENGTH (nm)

384
383
382
381
380
379
378
377

1   2   3   4

NUMBER OF BI-LAYERS

- MDA
- DFD
- CAN

DAH
DAB

ENERGY SHIFT (eV)

0.014
0.012
0.010
0.008
0.006
0.004
0.002
0.000
-0.002

0   20   40   60   80   100   120   140   160

THIN FILM THICKNESS (A)

FIG.10A

ITENSITY (a.u.)

0.020
0.015
0.010
0.005
0.000

300 400 500 600 700

WAVELENGTH (nm)

FIG.10B

FIG.11

NH₂

44

NTCDA or PTCDA
ii

N = 0,1

NH₂COCH₃
NH₂
H₂N
NH₂COCH₃
iii

H₃COCH₂N
NH₂

N = 0,1

REPEAT ii-iii

LADDER STRUCTURE
CONTAINING
MULTILAYERS

$P1 = [N = 0]$
$P2 = [N = 1]$

FIG.12A

44

NTCDI
or
PTCDI
ii

N = 0,1

R₂MX₂

R = Me, Et
X = Cl, Br, I
M = Si, Ge

iii

REPEAT
ii-iii

METALLO-ORGANIC
CONTAINING
MULTILAYERS

P3 = [N = 0]
P4 = [N = 1]

N = 0,1

FIG.12B

FIG.12C

EL
ITENSITY

EL
ITENSITY

26
24
22
20
18
16
14
12

3500
3000
2500
2000
1500
1000
500
0

0   1   2   3   4
VOLTAGE (V)

0   2   4   6   8
VOLTAGE (V)

FIG.13A

CURRENT
(mA)

5
4
3
2
1
0

0   1   2   3   4   5   6   7   8   9
VOLTAGE (V)

FIG.13B

FIG.14

FIG.15.

FIG.16

VECTORIAL ELECTORN
TRANSPORT LAYER BY
MLE DERIVED OMQW

VECTORIAL HOLE
TRANSPORT LAYER BY
MLE DERIVED OMQW

CATHOD

EMITTER

LOW WORK FUNCTION
METAL(S) [Mg:Ag]

MLE
DERIVED ORGANIC
SEMICONDUCTING POLYMER

HIGH WORK FUNCTION
METAL (ITO)
or semiconductor

FIG.17A
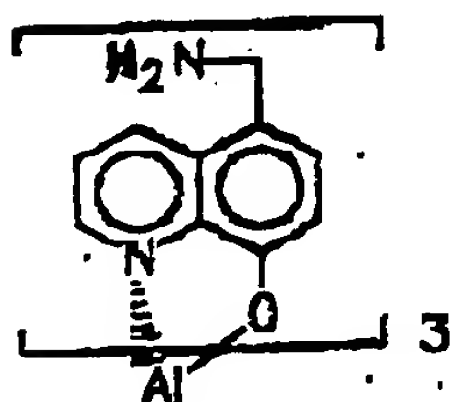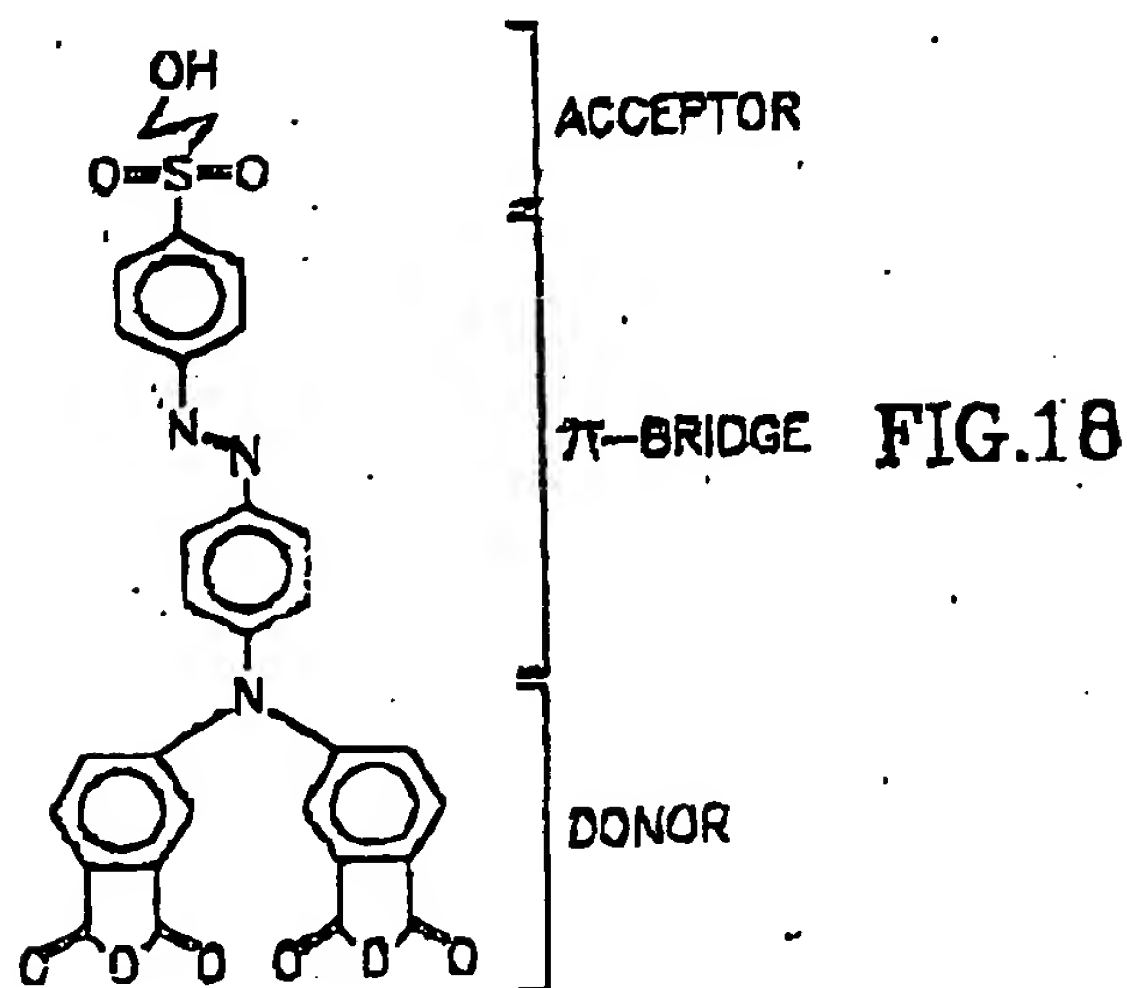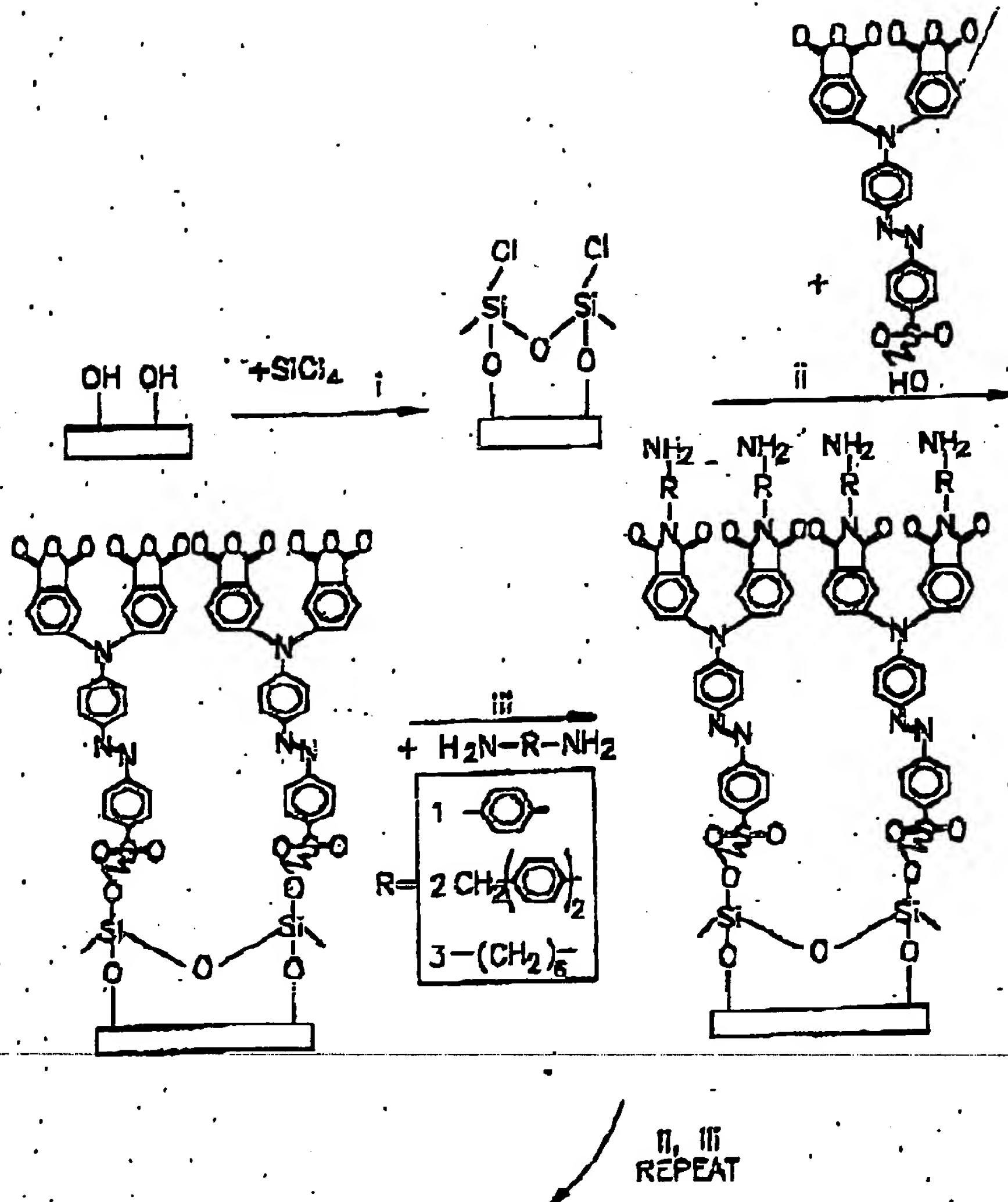
H_2N

N

O

Al

3

FIG.17B

OH

$O=S=O$

N=N

N

ACCEPTOR

π-BRIDGE   **FIG.18**

DONOR

ORGANIC SUPERLATTICE

FIG.19